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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/672,151	09/26/2003	Keren Jacobs	LAM1P178/P1189	8126
22434	7590	05/03/2005	EXAMINER	
BEYER WEAVER & THOMAS LLP P.O. BOX 70250 OAKLAND, CA 94612-0250			TRAN, BINH X	
			ART UNIT	PAPER NUMBER
			1765	
DATE MAILED: 05/03/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/672,151

Applicant(s)

JACOBS ET AL.

Examiner

Binh X. Tran

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 February 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 and 13-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 14 and 15 is/are allowed.
- 6) ☒ Claim(s) 1-10, 13 and 16-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 01/18/2005.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 16-17 are rejected under 35 U.S.C. 102(e) as being anticipated by Gabriel et al. (US 6,599,839).

Respect to claims 1 and 16, Gabriel discloses a method for etching a feature in an etch layer (14) through as mask (photoresist mask 16) over a substrate (12), comprising:

placing a substrate in a process chamber;

providing an etch plasma to the process chamber, wherein the etch plasma begin to etch (col. 5 lines 31-67);

etch a feature in the etch layer (14) with the etch plasma (col. 5 line 58 to col. 6 lines 3);

ramping at least one etch plasma parameter (i.e. etchant flow rate) during the etching of the feature to optimized plasma parameters to the changing etch depth and etching with the ramped plasma until the feature is etched to a feature depth, wherein

the ramping is continuous ramping (col. 6 lines 22-67, Fig 2A-2B; Fig 3A-4). Respect to claim 17, Gabriel discloses the ramping occurs over a time period of 50-60 seconds (Fig 2A-2B, Fig 3A-4, read on "greater than 30 seconds").

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 2-8, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gabriel and further in view of Fuse et al. (US 2003/0153193 A1).

Respect to claim 2, Gabriel fails to explicitly disclose the ramping step is selected from at least one of: providing a ramp that increase etch aggressiveness with respect to etch to increase feature depth, providing a ramp that increase etch aggressive with respect to tapered profile, providing a ramp that increase overall

Art Unit: 1765

selectivity to the mask by ramping from recipe with higher mask selectivity to lower selectivity, providing a ramp that moves bow location to decrease overall bowing, and providing a ramp that reduce overall striations. However, Gabriel clearly teaches to ramp the plasma parameters in order to enhance the etching of film additive or increase the etch rates (col. 5 lines 30-45). In a semiconductor process, Fuse teaches to ramp the plasma parameter from recipe with higher mask selectivity to lower selectivity during etching the SiO₂ film (Fig 3, paragraph 0022-0023). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Gabriel in view of Fuse by ramping from recipe with higher mask selectivity to lower selectivity because this technique will enhance the selectivity SiO₂ layer over the mask layer (i.e. resist layer).

Respect to claims 3-4, Gabriel discloses the etch layer (14) is a single layer having uniform thickness. Respect to claim 5, Gabriel discloses the ramping occurs over a time period of 50-60 seconds (Fig 2A-2B, Fig 3A-4, read on "greater than 30 seconds"). Respect to claim 6, Gabriel discloses ramping occurs over greater than 50% of the duration of the etch process (Fig 2A). Respect to claim 7, Gabriel discloses the ramping is non-linear ramping (Fig 3A-3B). Respect to claim 8, Gabriel discloses the etch layer is a dielectric layer (col. 4 lines 25-32, lines 45-60).

Respect to claim 10, Fuse disclose the ramping decreases etch selectivity between the etch layer (SiO₂) and the mask (resist), wherein the etching rate of the SiO₂ is increased (See Fig 3). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Gabriel in view of Fuse by decrease etch

Art Unit: 1765

selectivity between the etch layer (SiO_2) and the mask because will increase the etch rate of SiO_2 film and reduce the etching time.

6. Claims 2-3, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gabriel in view of Wang et al. (US 6,040,619).

Respect to claims 2 and 9, Gabriel fails to disclose that the ramping increases etch aggressive with respect to etch stop. However, Gabriel clearly teaches that the ramping increase the etching rates (col. 5 lines 30-45, read on "increase etch aggressive"). Wang discloses a process to increase etch aggressive with respect to etch stop (col. 4 line 55 to col. 5 line 5). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Gabriel in view of Wang by increasing etch aggressive with respect to etch stop because it will reduce the etching time for the etch stop. The limitation of claim 3 has been discussed above under Gabriel's reference.

7. Claims 13, 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stolze (US 6,449,038) in view of Gabriel.

Respect to claim 13, Stolze discloses an apparatus for etching comprising a plasma processing chamber comprising:

- a chamber wall forming a plasma processing chamber enclosure;
- a substrate support (52) for supporting a substrate;
- a pressure regulator for regulating the pressure in the plasma processing chamber enclosure;
- at least one electrode for providing power (RF power) to the plasma processing

Art Unit: 1765

chamber enclosure for sustaining a plasma (col. 7 lines 10-25);

a gas inlet (38) for providing gas into the plasma processing chamber;

a gas outlet (i.e. exhaust 42) for exhausting gas from the plasma processing chamber enclosure;

a gas source (36) in fluid connection with the gas inlet (38);

a controller controllably connected to at least one of the gas source, the at least one electrode, the pressure regulator, gas inlet/outlet, comprising:

at least one processor (i.e. CPU); and

computer readable media (i.e. disk drive) comprising computer readable code (i.e. computer program) (See col. 10, Fig 5).

Stolze fails to disclose that the computer readable code is used for ramping at least one the parameter during the etching of the feature to optimize plasma parameters according to etch depth. In a plasma etching method, Gabriel teaches ramping at least one etching parameter during the etching of the feature to optimize plasma parameters to the changing etch depth and etching with the ramped plasma until the feature is etched to a feature depth. It would have been obvious to one having ordinary skill in the art, at the time of invention to modify Stolze in view of Gabriel by ramping the etching parameters because this technique provide more control of the etching process.

Respect to claim 18, Gabriel disclose the ramping is a continuous ramping (Fig 3A). Respect to claim 19, Gabriel discloses the ramping occurs over a time period of 50-60 seconds (Fig 2A-2B, Fig 3A-4, read on "greater than 30 seconds").

Allowable Subject Matter

8. Claims 14-15 are allowed.
9. The following is a statement of reasons for the indication of allowable subject matter: The reason for allowance was discussed in previous office action.

Response to Arguments

10. Applicant's arguments, see page 6-8, filed 2-08-2005, with respect to the rejections of claims 1-13 under 35 U.S.C 102 (b) and 103 have been fully considered and are persuasive. The examiner decides to withdraw the previous grounds of rejection because applicants amend the independent claims to insert the new limitation "wherein the ramping is at least one of a continuous ramping and a series of discrete steps that mimic a continuous ramp". However, upon further consideration, a new ground(s) of rejection is made as discussed above. The examiner also rejects new claims 16-19 under 35 U.S.C 103 (a) as discussed above.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

Art Unit: 1765

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER
